would expect. If we look to the animal world we shall, broadly speaking, find that as we rise from the lowliest to the highest organisms, there is a steady decrease in the number of offspring, while at the same time there is a lengthening of the period during which the offspring remain under the care of the parents. In the case of the human race we find that increasing civilisation brings with it a decreasing birth-rate, and a lengthening period of "schooling" for the children; and it is amongst the least intelligent (which is also usually the lowest paid) section of the community that the birth-rate is the highest. A glance at the birth-rate of our English towns will show that in those districts where there is greatest poverty and congestion, there tends to be also a comparatively large birth-rate.

The foregoing views would seem to be borne out by the fact which Miss Elderton mentions, that Liverpool, "which is not a cotton town, and where the amount of irregular and casual labour is singularly large, is one of the two cases in Lancashire where the birth-rate shows a rising tendency," and also by her statement that "from Bradford figures have been obtained showing how in homes where the mother's health or habits are bad, or where the ventilation is bad, there is on an average about one child more than in homes where these features are good."

To quote the words of Dr. Saleeby, "a chief factor of progress has been the supersession of the quantitative by the qualitative criterion of survival-value. The principle of the fall of the birth-rate is one of the great consistent facts of organic history, and may be traced from the bacteria upwards, through such representative invertebrates as the insects, even through fishes, the first vertebrates, up to man, and amongst the various nations and strata of human society. The tendency of progress, in short—a tendency coincident with the evolution of ever higher and higher species—is to pass from the horrible Gargantuan wastefulness of the older methods towards the evident but yet lamentably unrealised ideal—that every child born shall reach maturity. . . . All organic history proves that a low birth-rate is a mark of high vital level."

J. Anderson.

17 Laburnum Road, Gorton, Manchester,
March 5.

The above letter contains no addition of any ascertained *fact* to those cited by Miss Elderton. Miss Elderton, in her lecture, brought forward a very large amount of evidence to show that the *net* family of the socially less valuable members of the working-classes was larger than that of the socially more valuable members of the same classes. That within a given species the individuals of inferior physique and mentality have relatively greater fertility must mean the degeneration of that species; and no scientific argument can be opposed to this based upon the illogically extended syllogism: "higher" species have lower birth-rates; there is a lower birth-rate in the more valuable members of the artisan classes; hence this tends to convert those classes and their nation into "higher" types of life.

If we start to reason from analogy of this kind, we might argue that the elephant would in the end supplant man, or that the mastodon—for aught we can say to the contrary—ought to have survived all his contemporaries. It is the old fallacy of the Neo-Malthusians, who have never made any real attempt to grasp the race suicide involved in the survival of the unfit by reproductive selection—*i.e.* by their greater fertility, when it is unchecked by natural selection. Argument from analogy, when data are available, is always idle; argument from what is known of species to what must hold of individuals is still more fallacious.

Lastly, association is not causation; a "higher" individual may have fewer children, but this does not demonstrate that his height (however that vague word be defined) is produced by his lesser fertility, or that a race with a large section of its "higher" individuals practically sterile will survive in the battle of nations. History shows many cases of the decline of nations whose intellectually abler members were sterile. I can recall no case of a race with a very low birth-rate maintaining or creating a position for itself in the assembly of nations.

I have not trespassed on your space by commenting on Mr. Anderson's other statements. He was clearly not present at Miss Elderton's lecture, or he would have been aware that her data were all based on *married* women, and had due reference to their *ages*. While the actual birth-rate of wives, fifteen to forty-five years of age, has fallen 30 per cent. to 50 per cent., the *potential* birth-rate of the same wives has fallen a few points, or in many districts not at all.

Karl Pearson.

Galton Laboratory for National Eugenics,
University of London, March 11.

The Radio-Elements and the Periodic Law.

In his letter in Nature of March 20 Mr. Soddy states that "granting the possibility of the existence of groups of elements with identical chemical properties and spectra, the only known direct manner in which the existence of the members of these groups could be separately recognised is radio-active evidence." I should like to suggest that another possible method of distinguishing such elements is provided by their characteristic X-radiation. According to Rutherford, the γ-radiation emitted by a radio-active element is identical with its characteristic X-radiation; is the γ-radiation of thorium D identical with the characteristic X-radiation of thallium, or the γ-radiation of radium D with the characteristic X-radiation of lead? From such experimental results as I can discover after a brief search, it would appear that the answer to this question is in the negative.

It seems probable that a difference might exist between the characteristic X-radiations of elements chemically identical, for the properties of that radiation, like the radio-active properties, are probably determined by the fixed electrons, forming part of the permanent structure of the atom, since both sets of properties are independent of chemical combination; on the other hand, the chemical properties are probably determined by the valency electrons which are readily detached from the atom. If chemically identical elements have the same spectra, it would appear that the spectra are also determined by the valency electrons, a conclusion contrary to that involved in Stark's theory of the origin of spectra.

Norman R. Campbell.

Leeds, March 23.

The Occurrence of the Archiannelid, Protodrilus, on the South Coast of England.

The discovery of the presence of the Archiannelid, Protodrilus, on the English coast is an interesting fact inasmuch as it extends the known domain of a genus of an archaic group of animals, and also adds a valuable animal to our records. So far as is known

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Protodrilus appears to inhabit only the European seas,[1] having been taken in the Black Sea, the Mediterranean, at Heligoland in the North Sea, and at Ambleteuse, on the French side of the Straits of Dover. Protodrilus was found on March 2 in a small bay just outside and to the east of Plymouth Sound. On March 11 the spot was again visited, and a large number of specimens, more than a hundred, gathered in about an hour. The animals were found almost at the high-water mark among stones and gravel at a point where a small stream of fresh water runs into the sea.

It is an interesting fact that the animals are immersed at one period in practically fresh water, and at another period in sea water; samples of the water in which the animals were living taken at low water during the neap and spring tides were found to have densities as indicated by a hydrometer of about 1·001 and 1·009 respectively; while the density of a sample of sea water taken just outside the breakwater at Plymouth, estimated by the same instrument, was found to be about 1·025.[2]

These specimens of Protodrilus are undoubtedly different from those previously taken at Ambleteuse and Heligoland, but they resemble in some characters both the Mediterranean forms, *Protodrilus flavocapitatus,* Uljanin, and *Protodrilus spongioides,* Pierantoni. The former of these species occurs in situations which are never covered by more than a few decimetres of water, while the latter is represented by only four specimens taken from fresh water. A fuller investigation of the English specimens is being undertaken in order to compare them in more detail with the known species of this genus.

The English Protodrilus were living in the situation described above along with *Gammarus marinus,* an Oligochæte and *Gunda* (*Procerodes*) *ulvae*; the latter of these species was first taken in this spot in great numbers two years ago, and does not appear to have been recorded previously on the English coast.

J. H. ORTON.

The Laboratory, Citadel Hill, Plymouth.

On the Gain of Definition obtained by Moving a Telescope.

THE following is an account of a very singular fact which came recently under my notice, and for the explanation of which I am absolutely at a loss.

I am in the habit of rating my chronometer by means of the time-ball dropped at the Greenwich Royal Observatory, about $3\frac{1}{8}$ miles away, a signal which I observe in a small hand telescope.

On March 11, the weather being misty, I failed to pick the signal post, although I knew exactly where it was, and had placed the telescope exactly in the right direction. I moved the telescope a little, thinking I had displaced it in putting my eye to the eye-piece, and I immediately saw, very dimly, the dome of the observatory, and the signal, with the ball at half-mast, and noticed that *they were in the centre of the field all the time.* As soon as I steadied the telescope, however, they vanished completely. They reappeared as soon as I began to "sweep" for them, but remained discernible only while the motion lasted. I repeated the experiment several times; the signal was really invisible while the telescope was fixed, but by imparting to it a slow oscillation right and left I kept the signal in view with sufficient distinctness to see the ball drop, although I was not certain it had really dropped until a second or so afterwards, owing to the great faintness of the image observed.

I recollected then that, often, in similar conditions of seeing, having picked the signal without any difficulty *while "sweeping" for it,* I had failed to see it afterwards, and gave up the attempt, thinking I had been mistaken, or that the mist had become thicker. I have therefore no doubt as to this most curious and inexplicable fact: an indistinct object is better seen in a slowly moving telescope than in the same telescope when kept steady. There must be a very interesting physiological property of the eye involved in producing this result, which is quite in opposition with what one would naturally expect. Perhaps some of your readers have noticed something similar, and could throw a little light on this mysterious phenomenon.

M. E. J. GHEURY.

Woolwich Polytechnic, March 15.

Four-horned Sheep.

MR. RITCHIE'S note on four-horned sheep in NATURE of March 6 is interesting, but I am inclined to doubt whether there ever was, in Scotland or any other country, a breed in which four horns are normal. No doubt it is possible to fix this character in the male sex by careful selection, as has been done by some breeders of the spotted or Barbary sheep (sometimes called Spanish, Syrian, or Zulu sheep); but even these have not succeeded in fixing the character in the female sex. I have evidence, in the shape of specimens or photographs, of the existence of four-horned sheep in North and South Africa, Mongolia, China, the Himalayas, Baluchistan, and Chile. The Iceland breed was supposed to be four-horned, and no doubt four-horned examples were often found amongst them, a specimen I have being precisely similar in type to an abnormally four-horned Shetland.

My own experience of four-horned rams is that in most cases the lower horns, and in some cases the upper also, require to be cut at some time in their life to prevent them from growing into the cheek, or below the jaw, so that the animal cannot graze; and this no doubt would have a tendency to eliminate the four-horned rams where not specially selected. No instance is on record, so far as I know, of any wild sheep having more than two horns, neither have I seen any skull of domestic sheep in which there were more than four horn-cores, though five-, six-, and even eight-horned sheep have been recorded.

H. J. ELWES.

Colesborne Park, near Cheltenham, March 14.

THE EXPERIMENTAL STUDY OF FLUID MOTION.[1]

MANY attempts have been made to study the motion of fluids past an obstacle by experimental methods, and experiments made for this purpose may be divided roughly into two classes:

(*a*) Those in which the fluid is made to flow

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[1] U. Pierantoni, "Fauna und Flora des Golfes von Neapel." Vol. xxxi. Protodrilus. 1908.

[2] These values of density were made at temperatures between 15° and 17° C., and are to be regarded as approximations only to the absolute density: as the water in which the Protodrilus were living would be constantly changing, it was not considered worth while to analyse accurately two random samples.

[1] The figures which accompany this article are from the Technical Report of the Advisory Committee for Aëronautics for the year 1911–12, and are reproduced with the permission of the Controller of H.M. Stationery Office.

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